MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

PEM0026 – TRIGONOMETRY AND GEOMETRY

(Foundation in Engineering)

6 MARCH 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **4** pages including the cover page.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown.
4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

TRIGONOMETRY IDENTITIES

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B$

$\cos(A\pm B)=\cos A\cos B\mp\sin A\sin B$

$\tan(A\pm B)=\dfrac{\tan A\pm\tan B}{1\mp\tan A\tan B}$

$2\sin A\cos B=\sin(A+B)+\sin(A-B)$

$2\cos A\cos B=\cos(A+B)+\cos(A-B)$

$2\sin A\sin B=\cos(A-B)-\cos(A+B)$

$\sin A+\sin B=2\sin\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\sin A-\sin B=2\cos\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\cos A+\cos B=2\cos\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\cos A-\cos B=-2\sin\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\sin^2\dfrac{A}{2}=\dfrac{1-\cos A}{2}$; $\cos^2\dfrac{A}{2}=\dfrac{1+\cos A}{2}$; $\tan^2\dfrac{A}{2}=\dfrac{1-\cos A}{1+\cos A}$

$\sin\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{2}}$; $\cos\dfrac{A}{2}=\pm\sqrt{\dfrac{1+\cos A}{2}}$; $\tan\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{1+\cos A}}=\dfrac{1-\cos A}{\sin A}=\dfrac{\sin A}{1+\cos A}$

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QUESTION 1 (25 MARKS)

a) Given $\sin\theta = \frac{\sqrt{35}}{10}$ and $\cos\theta = -\frac{\sqrt{51}}{10}$, find the exact values for the four remaining trigonometric functions of θ using identities. (5 marks)

b) Simplify the expression:

$$\csc 40^\circ\left(\sin 40^\circ + \cos 50^\circ\right) + \frac{1}{\sec^2 40^\circ} + \frac{\cos\left(-50^\circ\right)}{\csc 40^\circ} \quad \text{(5 marks)}$$

c) Graph $y = -\sin\left(2x - \frac{\pi}{4}\right) + 1$ for $0 \le x \le 2\pi$. State its amplitude, period and phase shift. Show the x-intercepts. (8 marks)

d) A triangle ABC is given. If BC, CA, AB are a, $a+d$, and $a+2d$ respectively, show that $\cos C = \frac{1}{2} - \frac{3d}{2a}$. (7 marks)

QUESTION 2 (25 MARKS)

a) Prove that, $\frac{\sin 5\theta - \sin 3\theta}{\cos 5\theta + \cos 3\theta} = \tan\theta$. (5 marks)

b) Determine the exact value of $\cos\left[\sin^{-1}\left(\frac{1}{3}\right) + \cos^{-1}\left(-\frac{3}{7}\right)\right]$. (8 marks)

c) Solve the following equations for $0^\circ \le x \le 360^\circ$:

i. $2\cos\left(x + 20^\circ\right) + 1 = 0$ (5 marks)

ii. $\cos 2x + 3 = -7\sin x$ (7 marks)

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QUESTION 3 (25 MARKS)

a) Find the complex cube roots of $1+i$. Leave your answers in polar form with the argument in degrees. (7 marks)

b) Simplify and give your answer in the form of $x+yi$ for $\frac{2i(1+3i)}{(1-3i)^2}-\frac{11}{2i^9}+3-i^5$.

(6 marks)

c) Given $P_1=(1,-2)$ and $P_2=(3,-6)$. Find

i. the position vector v equal to $\overrightarrow{P_1P_2}$, (2 marks)

ii. the unit vector in the direction of v, (3 marks)

iii. the angle between v and $w=2i+5j$. (3 marks)

d) Transform the equation $r=6\cos\theta$ from polar coordinates to rectangular coordinates. (4 marks)

QUESTION 4 (25 MARKS)

a) Find the equation of the circle passing through the points $(0,1)$, $(1,-1)$ and $(4,3)$.

(10 marks)

b) Sketch the graph of $(y-2)^2=12(x-1)$ showing clearly the vertex, focus and directrix of the parabola. (6 marks)

c) Write the equation $9x^2-y^2-36x-2y-46=0$ in standard form. Hence, find the center, foci, vertices and asymptotes. (9 marks)

End of Paper